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Chapter Four

The Renaissance

"Then felt I like some watcher of the
skies

When a new planet swims into his ken;
Or like stout Cortez when with eagle
eyes

He star'd at the Pacific—and all his men
Look'd at each other with a wild
surmise—

Silent, upon a peak in Darien. (John
Keats)

"Eppur si muove."

"But it does move." (Galileo Galilei)

Modern science takes its starting point from the Renaissance, that marvellous period of spiritual and intellectual rebirth, which put an end to the thousand year reign of ignorance and superstition. Humanity once again looked to nature with eyes unblinkered by dogma. They rediscovered the wonders of classical Greek philosophy, directly translated from reliable versions which reached Italy after Constantinople was taken by the Turks. The materialist world outlook of the old Ionians and the atomists pointed science onto the right path.

This was a revolutionary period in every sense of the word. Luther not only

started the Reformation in religion, but also reformed the German language. At the same time, the Peasants' War in Germany, with its communistic overtones, pointed the way to future class struggles. "The dictatorship of the Church over men's minds was shattered," wrote Engels, "it was directly cast off by the majority of the Germanic peoples, who adopted Protestantism, while among the Latins a cheerful spirit of free thought, taken over from the Arabs and nourished by the newly-discovered Greek philosophy, took root more and more and prepared the way for the materialism of the eighteenth century." (Engels, *The Dialectics of Nature*, p. 30.)

The discovery of America and the sea route to the East Indies opened up new horizons for trade and exploration. But even vaster horizons came into view in the field of the intellect. The old narrow one-sidedness became impossible. It was necessary to break down all the old barriers in order to get at the truth. As in all revolutionary epochs, at this time there was a burning desire to know.

The development of science is closely linked to the growth of technology, which, in turn, is connected to the development of the productive forces. Take astronomy. The cosmological speculations of the ancient Greeks were limited by the lack of telescopes which

could aid their observations. In the year 137 A.D., observers had tabled the existence of 1,025 planetary bodies. By 1580, the number was exactly the same, and was arrived at using the same instrument—the naked eye.

Today's astronomers, using powerful radio telescopes, can observe a vast array of stars and galaxies. This fact has transformed astronomy. Unfortunately, the advances of technology have proceeded far more rapidly than the development of the ideas in the minds of men and women. In many respects, the world outlook of some scientists in the last decade of the 20th century has more in common with that of the mediaeval

Church than the heroes of the Renaissance whose struggles against philosophical obscurantism made modern science possible.

Anaximander and Anaxagoras held that the universe was infinite—it had no beginning and no end. Matter could not be created or destroyed. This idea found acceptance with many other philosophers of Antiquity, and was summed up by the famous aphorism—*Ex nihilo nihil fit*—out of nothing comes nothing. It is therefore futile to look for a beginning or a creation of the universe, because it has always existed.

For the Church, such a view was

anathema, because it left the Creator out of the picture. In an infinite material world, there is no room for God, the Devil, the angels, heaven or hell.

Therefore they seized avidly upon the weakest and most puerile of Plato's writings, the *Timaeus*, which is really a creation-myth. On the other hand, they had the Ptolomeic system of the cosmos, which, in addition, corresponded to the cosmological scheme of Aristotle, whose authority was absolute at the time. This was the picture of a closed universe. The earth stood at the centre, enclosed by seven crystal spheres, on which the sun, the moon and the planets traced perfect circular orbits round the earth. This concept seems strange to

modern minds. But it actually was sufficient to explain many observable phenomena. In fact, from the standpoint of simple "common sense," it would seem that the sun goes round the earth and not vice-versa.

Despite this, the geocentric view was challenged even in Ptolomey's day. The alternative heliocentric theory was defended by Aristarchus of Samos (c. 310-230 B.C.), who put forward the complete hypothesis of Copernicus, that all planets, including the earth go round the sun in circles, and that the earth revolves on its axis every twenty four hours. This brilliant theory was discarded in favour of the Ptolomaic

view, because it fitted in with the Church's outlook. The earth stood at the centre of the universe, and the Church stood at the centre of the world.

Copernicus, the great Polish astronomer (1473-1543), had travelled to Italy in his youth, and was infected with the new spirit of inquiry and free thinking abroad. He soon came to accept that the sun was at the centre of the universe, but kept his ideas to himself for fear of the reaction of the Church. Only on his death bed did he decide to publish his book, *De Revolutionibus Orbium Coelestium* (On the Revolutions of the Heavenly Bodies), which he dedicated to the Pope, in the hope of escaping censure.

Temporarily, he succeeded. The book was not condemned until Galileo's time, when the Inquisition and the Jesuits, the shock-troops of the Counter Reformation were in full swing.

Tycho Brache, the Danish astronomer (1546-1601), took an intermediate position, arguing that, while the sun and moon go round the earth, the planets go round the sun. Far more important was the role of the German, Johannes Kepler (1571-1630), who made use of Brache's calculations to correct some inaccuracies in Copernicus' model, and put forward his three laws: that planets move, not in circles, but in ellipses; that the line joining a planet to the sun

sweeps out equal areas in equal times, and that the square of the period of revolution of a planet is proportional to the cube of its average distance from the sun.

These propositions struck a heavy blow against the orthodox positions of the Church. The planets had to move in circles because the circle was the perfect form. That had been the accepted view of all idealists since Pythagoras. Kepler's first law now meant that they moved in an ellipse—a far from perfect form! His second law was still more monstrous from the "official" point of view. Instead of a nice smooth movement, the speed of the planets in

orbit varied, being faster when nearer the sun, and slower when furthest away from it. How could this be compatible with the notion of the divine harmony of the universe?

The point is that, whereas Kepler's theories were based upon Brache's scrupulous observations, the position of the Church was based on an idealist theory which was simply assumed to be true. To the modern observer, the position of the opponents of Copernicus and Kepler seem absurd. Yet echoes of this idealist method are still to be heard today, when serious physicists and mathematicians defend their equations, not on their correspondence with the

known facts of observation, but on their alleged aesthetic value. This is a question we shall return to.

Galileo

The greatest Renaissance scientist of them all was probably Galileo (1564-1642). Having already made great discoveries in the field of projectiles and falling objects, Galileo, a convinced supporter of the Copernican position, was the first astronomer to make use of the recently invented telescope to investigate the heavens. His observations left not a single stone standing of the old view of the universe. The moon, far from being a perfect

sphere, was an irregular surface, with mountains and seas. Venus had phases like the sun, and, most important of all, Jupiter had four moons. The Church maintained that there were seven planets, because seven was a mystical number. How could there be eleven? The image of the professor refusing to look through Galileo's telescope has passed into the folklore of scientific history, summing up the clash of two antagonistic world outlooks.

In recent years, attempts have been made to minimise the Church's persecution of science. Pope John Paul II launched an investigation into the "Galileo Affair." That enquiry, published in 1992,

revealed "grave reciprocal misunderstandings," and errors on both sides. But it all happened in "a cultural context very different from ours." In October 1993, the Pope delivered a message to a Conference at Copernicus's alma mater, the University of Ferrara, commemorating the 450th anniversary of the publication of the Polish astronomer's book, *De Revolutionibus Orbium Coelestium*. He was, says the Pope, a man both of science and of faith. In fact, the only reason Copernicus escaped persecution by the Church was to make sure his book saw the light of day when he was in a very safe place—the cemetery!

Galileo was put on trial twice by the Inquisition, once in private (1616) and once in public (1633). The second time he was forced to recant his views. He promised never again to claim that the earth goes round the sun or rotates on its axis. In this way, the Church silenced the greatest scientist of the age, and in the process killed off science in Italy for a long time. A worse fate befell others. Giordano Bruno (1548-1600) was burnt at the stake in Rome after eight years imprisonment.

Bruno was an uncompromising materialist. He had been influenced by Nicholas of Cusa, who argued that the universe has no beginning or end in

space or time. Bruno's materialism was coloured by a kind of pantheism, the idea that God is everywhere and nowhere, that is, that God and nature are one and the same. In a concept similar to that of the old Ionian hylozoism, he held that matter was an active, self-moving substance, and that man and his consciousness was part of nature, which was a single whole. Following in the footsteps of Nicholas of Cusa, he argued that the universe is infinite. He deduced that the universe consisted of an infinite number of worlds, some of them possibly inhabited. It is easy to see why the Church saw these startlingly modern ideas as subversive. Bruno did not shrink from paying for them with his life.

The Roman Church did not have a monopoly of the persecution of new ideas. The Protestant Luther denounced Copernicus as "an upstart astrologer who strove to show that the earth revolves, not the heavens or the firmament, the sun or the moon." As Engels observes, "At that time, natural science also developed in the midst of the general revolution and was itself thoroughly revolutionary; it had indeed to win in struggle its right of existence. Side by side with the great Italians from whom modern philosophy dates, it provided its martyrs for the stake and the dungeons of the Inquisition. And it is characteristic that Protestants outdid Catholics in persecuting the free

investigation of nature. Calvin had Servetus burnt at the stake when the latter was on the point of discovering the circulation of the blood, and indeed he kept him roasting alive during two hours; for the Inquisition at least it sufficed to have Giordano Bruno simply burnt alive." (Engels, *Dialectics of Nature*, p. 32.)

Despite all reverses, the new mode of thinking, steadily gained ground, until, by the late 17th century, it had won a decisive victory. The same scientists, who, in the name of orthodoxy, had condemned the ideas of Galileo, in practice quietly dropped the discredited Ptolomeic cosmology. The discovery of

the circulation of the blood by William Harvey (1578-1657) revolutionised the study of the human body, destroying the old myths. The discoveries of science, more than the logical disputation of the philosophers, made the old views untenable.

Although the traditional methods of the Schoolmen remained in place for a long time, they were increasingly seen as out of step with reality. The growth of science proceeded on other lines, and with other methods—observation and experiment. Once again, England was in the vanguard in advocating the empirical method. The most prominent proponent of this was Francis Bacon (1561-1626),

who was for a time Lord Chancellor of England under King James I, until he lost his position as a result of being too successful in enriching himself by accepting gifts from litigants. Thereafter he put his talents to better use writing books.

Bacon's writings are full of sound, practical common sense, and are materialist in the English, that is empirical, sense of the word. The general spirit of his works is that of a good natured and witty man of the world. Unlike Sir Thomas More, Bacon was not the stuff that martyrs are made of. He accepts the orthodox religion, just because he attaches little importance to

general principles. But religion plays no role in his philosophy, which is inspired by the idea of developing learning as a means of increasing man's power over nature.

He reacted against the dogmatism of the Schoolmen, with their "unwholesome and vermiculate" disputes which end in "monstrous altercations and barking questions." The only times he displays real indignation is when he touches on this subject:

"This kind of degenerate learning did chiefly reign amongst the Schoolmen: who having sharp and strong wits, and abundance of leisure, and small variety

of reading, but their wits being shut up in the cells of a few authors (chiefly Aristotle their dictator) as their persons were shut up in the cells of monasteries and colleges, and knowing little history, either of nature or time, did out of no great quantity of matter and infinite agitation of wit spin out unto those laborious webs of learning which are extant in their books. For the wit and mind of man, if it work upon matter, which is the contemplation of the creatures of God, worketh according to the stuff, and is limited thereby; but if it work upon itself, as the spider worketh his web, then it is endless, and brings forth indeed cobwebs of learning, admirable for the fineness of thread and

work, but of no substance or profit." (F. Bacon, *The Advancement of Learning*, p. 26.)

Here we have the healthy reaction against the sterile method of idealism which, turning its back upon the real world, spins fancies out of its own head and takes them for the truth just because they correspond to a set of preconceived prejudices which are taken as axioms. Instead of this, Bacon urges us to "imitate nature, which doth nothing in vain." (Ibid., p. 201.) Significantly, he prefers Democritus the atomist to Plato and Aristotle. Speaking ironically of the Supreme Craftsman who was supposed to have created the world from nothing,

he asks a pertinent question:

"For if that great Workmaster had been of a human disposition, he would have cast the stars into some pleasant and beautiful works and orders, like the frets in the roofs of houses; whereas one can scarce find a posture in square, or triangle, or straight line, amongst such an infinite number; so differing a harmony there is between the spirit of man and the spirit of nature." (Ibid., p. 133.)

This is a very important point, and one that is too often forgotten by scientists and mathematicians, who imagine that their equations represent the ultimate truth. In nature there are no such perfect

forms, no triangles, no circles, no planes, only real material objects and processes, of which these ideal representations are only rough approximations. Bacon understood this very well, when he wrote:

"Hence it cometh, that the mathematicians cannot satisfy themselves except they reduce the motions of the celestial bodies to perfect circles, rejecting spiral lines, and labouring to be discharged of eccentrics. Hence it cometh, that whereas there are many things in nature as it were monodica, sui juris; yet the cogitations of man do feign unto them relatives, parallels, and conjugates, whereas no

such thing is." (Ibid.)

The abstract generalisations of science, including those of mathematics, are only of use insofar as they correspond to the real world, and can be applied to it. Even the most fruitful and ingenious generalisation will necessarily only reflect reality in an imperfect and one-sided way. The problem arises when idealists make exaggerated claims for theories which they elevate to absolute principles to which reality is expected to conform.

The most recent trend in science, chaos theory, is returning, on a much higher level, to the fruitful line of argument of

Bacon and the materialists of the Renaissance, who, in turn, represented the rediscovery of a much older tradition, that of the Greek materialism of the Ionic and atomic schools. Bacon evolved his own materialist conception of nature, based on the idea that matter was made up of particles endowed with manifold properties, one of which was motion, which he did not limit to mechanical motion, but advanced the brilliant hypothesis that heat itself is a form of motion. Motion is here regarded, not merely as an external impulse, as a mechanical force, but as an inherent quality of matter, a kind of vital spirit or inner tension. Marx likens it to the term used by the German philosopher Jakob

Böhme, "Qual," which cannot be easily translated, but which signifies extreme inner tension, or "torment," as with a living thing. Thus the primary forms of matter are endowed with movement and energy, almost like a living force.

Nowadays we would use the word energy. Compared with the lifeless, wooden mechanistic conceptions of the following century, this view of matter is strikingly modern, and comes close to the position of dialectical materialism.

This last observation brings us close to the heart of the matter. The real significance of Bacon's philosophy was that it pointed the way forward.

Although incomplete in itself, it

contained the seeds of future development, as Marx explains in *The Holy Family*:

"In Bacon, its first creator, materialism still holds back within itself in a naïve way the germs of a many-sided development. On the one hand, matter, surrounded by a sensuous, poetic glamour, seems to attract man's whole entity by winning smiles. On the other, the aphoristically formulated doctrine pullulates with inconsistencies imported from theology." (MECW, Vol. 4, p. 128.)

Bacon's theory of knowledge was strictly empirical. Like Duns Scotus, he emphatically denied the existence of

"universals." He developed the method of reasoning known as induction, which is already present in the works of Aristotle. This is a way of studying things experimentally, in which we proceed from a series of single facts to general propositions. As an antidote to the arid idealism of the Schoolmen, this was an important advance, but it had serious limitations, which later became an obstacle to the development of thought. Here we see the beginning of that peculiarly Anglo-Saxon aversion to theory, the tendency towards narrow empiricism, the slavish worship of the "facts," and a stubborn refusal to accept generalisations which has dominated educated thought in Britain and, by

extension, the United States, ever since.

The limitations of a strictly inductive method are self-evident. No matter how many facts are examined, it only takes a single exception to undermine whatever general conclusion we have drawn from them. If we have seen a thousand white swans, and draw the conclusion that all swans are white, and then see a black swan, our conclusion no longer holds good. These conclusions are hypothetical, demanding further proof. Induction, in the last analysis, is the basis of all knowledge, since all we know is ultimately derived from observation of the objective world and experience. Over a long period of

observation, combined with practical activity which enables us to test the correctness or otherwise of our ideas, we discover a series of essential connections between phenomena, which show that they possess common features, and belong to a particular genus or species.

The generalisations arrived at over a lengthy period of human development, some of which are considered as axioms, play an important role in the development of thought and cannot be so easily dispensed with. The thought-forms of traditional logic play an important role, establishing elementary rules for avoiding absurd contradictions

and following an internally consistent line of argument. Dialectical materialism does not regard induction and deduction as mutually incompatible, but as different aspects of the dialectical process of cognition, which are inseparably connected, and condition one another. The process of human cognition proceeds from the particular to the universal, but also from the universal to the particular. It is therefore incorrect and one-sided to counterpose one to the other.

Despite claims made to the contrary, it is impossible to proceed from the "facts" without any preconceptions. Such supposed objectivity has never existed

and will never exist. In approaching the facts, we bring our own conceptions and categories with us. These can either be conscious, or unconscious. But they are always present. Those who imagine that they can get along quite happily without a philosophy, as is the case with many scientists, merely repeat unconsciously the existing "official" philosophy of the day and the current prejudices of the society in which they live. It is therefore indispensable that scientists, and thinking people in general should strive to work out a consistent way of looking at the world, a coherent philosophy which can serve as an adequate tool for analysing things and processes.

In the Introduction to *The Philosophy of History*, Hegel rightly ridicules those historians (all too common in Britain) who pretend to limit themselves to the facts, presenting a spurious facade of "academic objectivity," while giving free reign to their prejudices:

"We must proceed historically—empirically. Among other precautions we must take care not to be misled by professed historians who...are chargeable with the very procedure of which they accuse the Philosopher—introducing a priori inventions of their own into the records of the Past...We might then announce it as the first condition to be observed, that we should

faithfully adopt all that is historical. But in such general expressions themselves, as 'faithfully' and 'adopt,' lies the ambiguity. Even the ordinary, the 'impartial' historiographer, who believes and professes that he maintains a simply receptive attitude; surrendering himself only to the data supplied him—is by no means passive as regard the exercise of his thinking powers. He brings his categories with him, and sees the phenomena presented to his mental vision, exclusively through these media. And, especially in all that pretends to the name of science it is indispensable that Reason should not sleep—that reflection should be in full play. To him who looks upon the world rationally, the world in

its turn presents a rational aspect. The relation is mutual. But the various exercises of reflection—the different points of view—the modes of deciding the simple question of the relative importance of events (the first category that occupies the attention of the historian), do not belong to this place." (Hegel, *The Philosophy of History*, p. 10.)

Bertrand Russell, whose views are diametrically opposed to dialectical materialism, makes a valid criticism of the limitations of empiricism, which follows in the same line as Hegel's remarks:

"As a rule, the framing of hypotheses is the most difficult part of scientific work, and the part where great ability is indispensable. So far, no method has been found which would make it possible to invent hypotheses by rule. Usually some hypothesis is a necessary preliminary to the collection of facts, since the selection of facts demands some way of determining relevance. Without something of this kind, the mere multiplicity of facts is baffling." (Op. cit., p. 529.)

Thus, the Baconian school of thought exercised a contradictory influence upon subsequent developments. On the one hand, by stressing the need for

observation and experiment, it gave a stimulus to scientific investigation. On the other hand, it gave rise to the narrow empiricist outlook that has had a negative effect on the development of philosophical thought above all in Britain. In *The Dialectics of Nature*, Engels points out the paradox that this same empirical school, which imagined that it had disposed of metaphysics once and for all, actually ended up accepting all kinds of mystical ideas, and that this trend "which, exalting mere experience, treats thought with sovereign disdain...really has gone to the furthest extreme in emptiness of thought." (Engels, *The Dialectics of Nature*, p. 68.)

The immediate battle against religion had been won. Science was set free from the bonds of theology which had kept it in thrall for so long. This was the prior condition for the giant leap forward of the next period, when more was achieved in a century than in the whole of the previous thousand years. But the new world outlook was still insufficiently developed, characterised in general by a shallow and naive empiricism, that was far from sufficient to get rid of religion and idealism once and for all. "The emancipation of natural science from theology," wrote Engels, "dates from this, although the fighting out of particular mutual claims has dragged on down to our day and in many minds is

still far from completion." (Ibid., p. 32.) One hundred years later, despite the undreamed-of advances of science and human knowledge, the war has still not been decisively won.

The Age of Immutability

During the Renaissance, as in ancient times, philosophy and science, which were mainly the same thing, looked upon nature as a single, interdependent whole. A series of brilliant hypotheses were advanced as to the nature of the universe, but could not be verified or developed further because of the existing state of technology and production. Only with the birth of capitalism, and

particularly with the beginnings of the industrial revolution did it become possible to investigate in detail the workings of nature in their different manifestations. This profoundly altered the way men and women looked at the world:

"Genuine natural science dates from the second half of the fifteenth century, and from then on it has advanced with ever increasing rapidity. The analysis of nature into its individual parts, the division of the different natural processes and objects into definite classes, the study of the internal anatomy of organic bodies in their manifold forms—these were the fundamental

conditions for the gigantic strides in our knowledge of nature that have been made during the last four hundred years. But this has bequeathed us the habit of observing natural objects and processes in isolation, detached from the general context; of observing them not in their motion, but in their state of rest; not as essentially variable elements, but as constant ones; not in their life, but in their death. And when this way of looking at things was transferred by Bacon and Locke from natural science to philosophy, it begot the narrow, metaphysical mode of thought peculiar to the last centuries." (Engels, Anti-Dühring, p. 25.)

In the writings of Thomas Hobbes (1588-1679) the materialism of Bacon is developed in a more systematic way. Hobbes lived in a period of revolution. A convinced monarchist, he experienced at first hand the storm and stress of the English Civil War. The impending victory of Parliament forced him to flee to France, where he met and clashed with Descartes. His royalist convictions should have endeared him to the monarchist exiles in whose midst he lived (for a while he taught mathematics to prince Charles). But, like Hegel, whose conservative politics did not prevent his philosophy from attracting the suspicions of the authorities, Hobbes ideas proved too radical for his

contemporaries. The materialist tone of his *Leviathan*, which appeared in 1651, provoked the wrath of the Church and government of France, while his theories of society offended the English exiles by their rationalism. By a supreme irony, Hobbes was forced to flee to England, where he was welcomed by Cromwell, on condition he abstained from political activity.

The Restoration of the monarchy after the death of Cromwell led to the imposition of severe restrictions on intellectual freedom. Baconians were expelled from Oxford and Cambridge, effectively undermining them as centres of science. Under the Licensing Acts

(1662-95) an iron censorship was re-imposed. Hobbes was afraid that the Bishops would attempt to have him burnt. He was suspected of atheism, and even mentioned in a parliamentary report on the subject. His book Behemoth was withheld from publication until 1679. After that, he could get nothing of importance published in England for fear of ecclesiastical repression.

It is not hard to see why he attracted such a reputation. Right from the first page of Leviathan, he proclaims the materialist doctrine in the most intransigent spirit. For him, there is absolutely nothing in the human mind

which does not originate in the senses:

"Concerning the Thoughts of man, I will consider them first Singly, and afterwards in Trayne, or dependence upon one another. Singly, they are every one a Representation or Apparence, of some quality, or other Accident of a body without us; which is commonly called an Object. Which Object worketh on the Eyes, Eares, and other parts of mans body; and by diversity of working, produceth diversity of Apparences.

"The Originall of them all, is that which we call SENSE; (For there is no conception in a mans mind, which hath not at first, totally, or by parts, been

begotten upon the organs of Sense.) The rest are derived of that originall."
(Leviathan, p. 3.)

Elsewhere, he comes close to attributing the origins of religion to primitive superstitions arising from phenomena such as dreams, although, for obvious reasons, he limits the application of this idea to non-Christian religions!

"From this ignorance of how to distinguish Dreams, and other strong Fancies, from Vision and Sense, did arise the greatest part of the Religion of the Gentiles in time past, that worshipped Satyres, Fawnes, Nymphs, and the like; and now adayes the opinion

that rude people have of Fayries, Ghosts, and Goblins; and of the power of Witches." (Ibid., p.7.)

Following in Bacon's footsteps, Hobbes appeals directly to nature, as the source of all knowledge:

"Nature it selfe cannot erre: and as men abound in copiousness of language; so they become more wise, or more mad than ordinary. Nor is it possible without Letters for any man to become either excellently wise, or (unless his memory be hurt by disease, or ill constitution of organs) excellently foolish. For words are wise mens counters, they do but reckon by them: but they are the mony of

fooles, that value them by the authority of an Aristotle, a Cicero, or a Thomas, or any other Doctor whatsoever, if but a man." (Ibid., p. 15-6.)

And, like Bacon and Duns Scotus, he follows in the tradition of nominalism, denying the existence of universals, except in language:

"Of names, some are Proper, and singular to one onely thing; as Peter John, This man, this Tree: and some are Common to many things; as Man, Horse, Tree; every of which though but one Name, is nevertheless the name of divers particular things; in respect of all which together, it is called as Universall; there

being nothing in the world Universall but Names; for the things named, are every one of them Individuall and Singular." (Ibid., p. 13.)

In comparison to Bacon, the method of Hobbes is much more worked-out, but at the same time becomes increasingly more one-sided, rigid, soulless, in a word, mechanistic. This was not accidental, since the science which was advancing most rapidly at the time was mechanics. Increasingly, the entire workings of the world came to be seen in terms borrowed from mechanics. Thus, for Hobbes, society was like a human body, which, in turn, was just a machine:

"Nature (the Art whereby God hath made and governes the World) is by the Art of man, as in many other things, so in this also imitated, that it can make an Artificial Animal. For seeing life is but a motion of Limbs, the begining whereof is in some principall part within; why may we not say, that all Automata (Engines that move themselves by springs and wheeles as doth a watch) have an artificiall life? For what is the Heart, but a Spring; and the Nerves, but so many Strings; and the Joynts, but so many Wheeles, giving motion to the whole Body, such as was intended by the Artificer? Art goes yet further, imitating that Rationall and most excellent worke of Nature, Man. For by Art is created

that great LEVIATHAN called a COMMON-WEALTH, or STATE, (in latine CIVITAS) which is but an Artificiall Man." (Ibid., p. 1.)

Marx sums up Hobbes' contribution in the following passage from The Holy Family:

"Hobbes, as Bacon's continuator, argues thus: if all human knowledge is furnished by the senses, then our concepts, notions, and ideas are but the phantoms of the real world, more or less divested of its sensual form. Philosophy can but give names to these phantoms. One name may be applied to more than one of them. There may even be names of names. But

it would imply a contradiction if, on the one hand, we maintained that all ideas had their origin in the world of sensation, and, on the other, that a word was more than a word; that besides the beings known to us by our senses, beings which are one and all individuals, there existed also beings of a general, not individual, nature. An unbodily substance is the same absurdity as an unbodily body. Body, being, substance, are but different terms for the same reality. It is impossible to separate thought from matter that thinks. This matter is the substratum of all changes going on in the world. The word infinite is meaningless, unless it states that our mind is capable of performing an

endless process of addition. Only material things being perceptible, knowable to us, we cannot know anything about the existence of God. My own existence alone is certain. Every human passion is a mechanical movement which has a beginning and an end. The objects of impulse are what we call good. Man is subject to the same laws as nature. Power and freedom are identical." (MECW, Vol. 4, p. 128-9.)

This mechanistic view of the world, in a sense, represents a step back in relation to Bacon. "Knowledge based upon the senses loses its poetic blossom," writes Marx, "it passes into the the abstract experience of the geometrician. Physical

motion is sacrificed to mechanical or mathematical motion; geometry is proclaimed as the queen of sciences. Materialism takes to misanthropy. If it is to overcome its opponent, misanthropic, fleshless spiritualism, and that on the latter's own ground, materialism has to chastise its own flesh and turn ascetic. Thus it passes into an intellectual entity; but thus, too, it involves all the consistency, regardless of consequences, characteristic of the intellect." (MECW, Vol. 4, p. 128.) Yet this type of mechanical materialism was to predominate for the next century and a half in Britain and France.

John Locke (1632-1704) continued in

the same direction as Hobbes, declaring that experience is the sole source of ideas. To him belongs the celebrated maxim nihil est in intellectu, quod non prius fuit in sensu—nothing is in the intellect which was not first in sense. It was Locke, with his Essay on the Human Understanding, who supplied the proof for Bacon's fundamental principle, that the origin of all human knowledge and ideas was the material world given to us in sense-perception. He is the philosopher of sound common sense, who "said indirectly that there cannot be any philosophy at variance with healthy human senses and the reason based on them." (MECW, Vol. 4, p. 129.) "Reason," he said, "must be our judge

and guide in everything." Locke's work was translated into French, and inspired Condillac and others to launch the French school of materialist philosophy, which prepared the ground intellectually for the Revolution of 1789-93.

The Advance of Science

The period from the end of the seventeenth and beginning of the eighteenth centuries saw a complete transformation of the world of science rooted in the conquests of the previous period. In England, the victory of the bourgeoisie in the Civil War, and the subsequent compromise of a constitutional monarchy after 1688,

provided relatively freer conditions for the development of scientific research and investigation. At the same time, the growth of trade and, increasingly, manufacture, created a need for more advanced technology and the capital necessary to pay for it. It was a period of unprecedented innovation and scientific advance.

Improvements in optics made possible the invention of the microscope. In France, Gassendi resurrected the atomic theories of Democritus and Epicurus. In Germany, Von Guericke invented the air-pump. Robert Boyle made significant progress in chemistry. The discoveries of Copernicus, Tycho Brache, Kepler,

Galileo and Huygens prepared the ground for Newton's revolution in astronomy, which were made necessary by the demand for more accurate navigation. The predominant method of science at the time was mechanistic: that is, that natural phenomena were to be interpreted in terms of form, size, position, arrangement, and motion of corpuscles, and their behaviour was to be explained exclusively in terms of contact with other particles.

The chief exponent of the new science was Sir Isaac Newton (1643-1727). Newton, who became President of the Royal Society in 1703, exercised a colossal influence, not just in science,

but in philosophy and the general mode of thinking of the period in which he lived and later. The poet Alexander Pope sums up the adulatory attitude of contemporary Englishmen with his verse:

"Nature and Nature's laws lay hid in night:
God said 'Let Newton be!' and all was light."

Newton was born on Christmas day 1642, the year when Galileo died and the Civil War broke out between Charles I and Parliament. In 1687, he published his famous Principia Mathematica, which set forth three laws of motion—

the law of inertia, law of proportionality of force and velocity, law of equality of action and counteraction, from which the basic principles of classical physics and mechanics were deduced. Here he set out and proved his theory of universal gravitation. This marks the definitive break with the old Aristotelean-Ptolomaic world-picture. Instead of celestial spheres operated by angels, Newton put forward a scheme of a universe functioning according to the laws of mechanics without the need for any divine intervention whatsoever, except for an initial impulse needed to set the whole thing in motion.

A typical product of the English

empirical school, Newton was not much bothered about this, preferring to ask no questions about the role of the Almighty in his mechanical universe. For their part, the religious Establishment, personified by Bishop Sprat, bowing to the inevitable, advocated a compromise with science, much like the compromise between King William and Parliament, which held in place for about a century, until it was overthrown by Darwin's discoveries. The demands of capitalism ensured that science was left in peace to get on with the job.

Like the great thinkers of the Renaissance, the scientists of Newton's age were mostly men with a broad

vision of science. Newton himself was not only an astronomer, but also a mathematician, optician and mechanic, and even a chemist. His contemporary and friend, Robert Hook, was not only the greatest experimental physicist before Faraday, but was also a chemist, mathematician, biologist and inventor, who shares with Papin the credit of preparing the way to the steam engine.

Invention of Calculus

The discovery of the infinitesimal calculus, which revolutionised mathematics, has been variously ascribed to Newton and Leibniz. It is possible that both came to the same

conclusion independently. In his Method of Fluxions, Newton sets out from the conception of a line as a "flowing quantity" (the "fluent"), and the velocity by which the line "flows" is described as its fluxion. Newton refers to a "moment" as an infinitely small length by which the fluent increased in an infinitely small time. This represented a complete break with the traditional method of mathematics, which totally excluded the concept of infinity and infinitesimals, which were not supposed to exist. The colossal advantage of this method was that it allowed mathematics for the first time to deal with motion. Indeed, Newton refers to it as the "mathematics of motion and growth." It

was this instrument that permitted him to formulate the laws of planetary motion discovered by Kepler as general laws of motion and matter.

The discovery of the infinitesimal calculus was fundamental for the whole development of science. Yet it involves a contradiction which immediately caused a controversy, which lasted a long time. The first detractor of calculus was none other than Bishop Berkeley, who objected to the use of infinitesimally small quantities. This, he argued, was in contradiction to logic, and therefore unacceptable. "What are these fluxions?" he asked. "The velocities of evanescent increments. And

what are these same evanescent increments? They are neither finite quantities, nor quantities infinitely small, nor yet nothing. May we not call them the ghosts of departed quantities?" (Quoted by Hooper, *op. cit.*, p. 322.)

Here again, we see the fundamental limitation of the method of formal logic. Its basic premise is the elimination of contradiction. Yet motion is a contradiction—that of being and not being in the same place at the same time. In the first volume of his *Science of Logic*, Hegel deals in detail with the differential and integral calculus, and shows that it deals with magnitudes that are in the process of disappearing,

neither before, when they are finite magnitudes, nor after, when they are nothing, but in a state which is and is not. This is in clear contradiction to the laws of formal logic, and hence provoked the indignant assaults of orthodox mathematicians and logicians. Despite all objections, the new mathematics achieved brilliant results in solving problems which could not be solved by the traditional methods. Yet when Newton published his Principia, he felt obliged to recast it in the form of classical Greek geometry, so as to cover up the fact that he had used the new method in all his calculations.

Newton also advanced the theory that

light was composed of particles, tiny corpuscles projected through space by luminous bodies. In the early 19th century, this theory was abandoned in favour of Huygen's wave theory, which was linked to the idea of the "ether," a hypothetical weightless, invisible medium, which, rather like the "dark matter" of modern astronomers, could not be detected by our senses, but which supposedly permeated space and filled the gaps between the air and other matter.

This theory seemed to explain all the known phenomena of light until 1900, when Max Planck put forward the idea that light was transmitted in small

packets of energy or "quanta." Thus, the old Newtonian particle theory was revived, but with a striking difference. It was discovered that sub atomic particles behave both like waves and particles. Such a contradictory and "illogical" concept shocked the formal logicians as much as the differential and integral calculus had done. Eventually, they were compelled reluctantly to accept it, purely because, as with the calculus, the theory was backed up by practical results. But at every decisive turn, we see the same clash between the real advances of science and the obstacles placed in its way by outmoded ways of thinking.

The revolutionary contribution of

Newton to science is not in doubt. Yet his legacy was not an unmixed blessing. The uncritical adulation which he received in his lifetime in England obscured the important role of his contemporaries, like Hooke, who anticipated his Principia by seven years, though without the necessary mathematical backing, and Leibniz, the German philosopher who was probably the real discoverer of the calculus. Several of his most important theories were in fact put forward much earlier by Galileo and Kepler. His major role was to systematise and sum up the discoveries of the past period, and give them a general form, backed up by mathematical calculations.

On the negative side, Newton's enormous authority gave rise to a new orthodoxy that was to inhibit scientific thinking for a long time. "His abilities were so great," writes Bernal, "his, system so perfect, that they positively discouraged scientific advance for the next century, or allowed it only in the regions he had not touched." (Bernal, *op. cit.*, p. 343.) The limitations of the English school of empiricism was summed up in his celebrated phrase: hypothesis non fingo—I make no hypotheses. This slogan became the battle cry of empiricism, yet bore absolutely no relation to the actual method of science, including that of Newton, who, for example, in the field

of optics, made "numerous conjectures as to the physical causes of optical and other phenomena and even partly propounding them as facts. Thus, in his explanation of what were afterwards called Newton's rings, he treated the alternate fits of easy transmission and easy reflection along a ray of light as experimentally established facts, which he then made use of." (Forbes and Dijksterhaus, op. cit., Vol. 1, p. 247.)

The advances of science were enormous. Yet the general world-view bequeathed by the period was conservative. The static and mechanical outlook coloured mens' minds for generations, as Engels points out:

"But what especially characterises this period is the elaboration of a peculiar general outlook, the central point of which is the view of the absolute immutability of nature. In whatever way nature itself might have come into being, once present it remained as it was as long as it continued to exist. The planets and their satellites, once set in motion by the mysterious 'first impulse,' circled on and on in their predestined ellipses for all eternity, or at any rate until the end of all things. The stars remained for ever fixed and immovable in their places, keeping one another therein by 'universal gravitation.' The earth had remained the same without alteration from all eternity or, alternatively, from

the first day of its creation. The 'five continents' of the present day had always existed, and they had always had the same mountains, valleys, and rivers, the same climate, and the same flora and fauna, except in so far as change or transplantation had taken place at the hand of man. The species of plants and animals had been established once for all when they came into existence; like continually produced like, and it was already a good deal for Linnaeus to have conceded that possibly here and there new species could have arisen by crossing. In contrast to the history of mankind, which develops in time, there was ascribed to the history of nature only an unfolding in space. All change,

all development in nature, was denied. Natural science, so revolutionary at the outset, suddenly found itself confronted by an out-and-out conservative nature, in which even today everything was as it had been from the beginning and in which—to the end of the world or for all eternity—everything would remain as it had been since the beginning." (Engels, *The Dialectics of Nature*, p. 34.)

The Decadence of Empiricism

Whereas the materialism of Bacon reflected the hopeful, forward-looking outlook of the Renaissance and the reformation, the philosophy of the late seventeenth and early eighteenth

centuries took shape in an altogether different climate. In England, the rich and powerful had received a shock in the period of the Civil War, with its "excesses." Having effectively broken the power of the absolute monarchy, the bourgeoisie no longer needed the services of the revolutionary petit bourgeoisie and the lower orders of society, the shock troops of Cromwell's Model Army, who had begun to give voice to their independent demands, not only in the field of religion, but by calling into question the existence of private property.

Cromwell himself had crushed the left wing represented by the Levellers and

Diggers, but the wealthy Presbyterian merchants of the City of London did not feel safe until, after Cromwell's death, they had invited Charles back from France. The compromise with the Stuarts did not last long, and the bourgeoisie was forced to eject Charles' successor James from the throne. But this time there was no question of appealing to the masses for support. Instead they called on the services of the Dutch Protestant, William of Orange, to take possession of the English throne, on condition of accepting the power of Parliament. This compromise, known as the "Glorious Revolution," (although it was neither) established once and for all the power of the bourgeoisie in England.

The stage was set for a rapid growth of trade and industry, accompanied by giant advances of science. In the realm of philosophy, however, it did not produce great results. Such periods are not conducive to broad philosophical generalisations. "New times," wrote Plekhanov, "produce new aspirations, the latter producing new philosophies." The heroic revolutionary age was past. The new ruling class wanted to hear no more of such things. They even baptised the real revolution, which had broken the power of their enemies, "The Great Rebellion." The men of money were guided by narrow practical considerations, and looked with distrust at theory, although they encouraged

scientific research which had practical consequences, translatable into pounds, shillings and pence. This mean-spirited egotism permeates the philosophical thinking of the period, at least in England, where it was only enlivened by the writings of satirists like Swift and Sheridan.

The further evolution of the empiricist trend revealed its limited character, which ended up by leading Anglo-Saxon philosophy into a cul-de-sac out of which it has still not emerged. This negative side of "sensationalism" was already evident in the writings of David Hume (1711-76) and George Berkeley (1685-1753). The latter was the bishop

of Cloyne in Ireland, who lived just at the end of a stormy period when Ireland had been drawn into the maelstrom of England's Civil War and subsequent dynastic and religious upheavals ending in the "Glorious Revolution" and the Battle of the Boyne, where the interests of the Irish people were betrayed in a struggle between an English and a Dutch Pretender, neither of whom had anything to do with them.

Reflecting the prevailing mood of philosophical conservatism, Berkeley was obsessed with the need to oppose what he saw as the subversive trends in contemporary science, which he interpreted as a threat to religion. An

astute, if not original thinker, he soon realised that it was possible to seize upon the weak side of the existing materialism, in order to turn it into its exact opposite. This he did quite effectively in his most important work, *A Treatise Concerning the Principles of Human Knowledge* (1734).

Taking as his starting point Locke's philosophical premises, he attempted to prove that the material world did not exist. Locke's empiricist theory of knowledge begins with the self-evident proposition: "I interpret the world through my senses." However, it is necessary to add the equally self-evident statement that the world exists

independent of my senses, and that the impressions I obtain through my senses come from the material world outside me. Unless this is accepted, we very quickly land up in the most grotesque mysticism and subjective idealism.

Berkeley was well aware that a consistent materialist position would lead to the complete overthrow of religion. He was, for instance, deeply suspicious of the new science, which seemed to leave no room for the Creator. Newton professed himself a believer. But his explanation of the universe as a vast system of moving bodies, all acting in accordance with the laws of mechanics, shocked the bishop. Where

did God come into all this? he asked. True, Newton assigned to the Almighty the task of getting it all started with a push, but after that, God did not seem to have been left very much to do!

Locke, like Newton, never renounced religion, but the bare declaration that God exists (deism), while giving Him no real role in the affairs of man or nature was merely a convenient fig leaf to conceal unbelief. As Marx put it, "for materialism, deism is but an easy-going way of getting rid of religion." (MECW, Vol. 4, p. 129.) Following Newton, Locke was happy to take for granted the existence of an obliging Deity who, after giving the universe a bit of a shove, then

retired to the celestial sidelines for the rest of eternity to allow men of science to get on with their work. It was the philosophical equivalent of the constitutional monarchy established as a compromise between parliament and William III after the "Glorious Revolution" of 1688, which, incidentally, was Locke's political ideal.

The deist disguise, however, did not fool Berkeley for a moment. There was an evident weak link. What if the universe did not start in this way? What if it had always existed? Locke and Newton assumed that, following the laws of elementary mechanics, a clockwork universe must have commenced with an

external impulse. But there was no way they could disprove the contrary assertion, that the universe had existed eternally. In that case, the last vestige of a role for the Creator vanished altogether. Locke also supposed that, in addition to matter, the universe contained "immaterial" substances, minds and souls. But, as he himself confessed, this conclusion did not flow necessarily from his system.

Consciousness might just be another property of matter (which is just what it is in fact)—the property of matter organised in a certain way. Here too, Locke's concessions to religion hung uneasily from his materialist premises, as if they had been tacked on as an

afterthought.

Berkeley's philosophy, like that of Hume, is the expression of a reaction against the revolutionary storm and stress of the previous period, identified in his mind with materialism, the root cause of atheism. Berkeley consciously set out to eradicate materialism once and for all, by the most radical means—by denying the existence of matter itself. Beginning with the undeniable assertion that "I interpret the world through my sense," he draws the conclusion that the world only exists when I perceive it—*esse is percipi* (to be is to be perceived). "The table I write on I say exists, that is, I see and feel it; and if I

were to go out of my study I should say it existed—meaning thereby that if I was in my study I might perceive it, or that some other spirit actually does perceive it...

"For, what are the forementioned objects but the things we perceive by sense? And what do we perceive besides our own ideas or sensations? And is it not plainly repugnant that any one of these, or any combination of them, should exist unperceived?" (Berkeley, *The Principles of Human Knowledge*, pp. 66-7.)

This, then, is where empiricism, inconsistent materialism, gets us when carried to its logical, or, rather,

illogical, conclusions. The world cannot exist unless I observe it. For this is exactly what Berkeley says. In fact, he considers it strange that anyone should believe otherwise: "It is indeed an opinion strangely prevailing amongst men, that houses, mountains, rivers, and in a word all sensible objects, have an existence, natural or real distinct from their being perceived by the understanding." (Ibid., p. 66.) The question arises as to what it is that makes the world real by the mere act of perceiving it. Berkeley replies: "This perceiving, active being is what I call MIND, SPIRIT, SOUL, or MYSELF." (Ibid., p. 65.)

All this is admirably clear and unambiguous. It is the doctrine of subjective idealism, with no "ifs" or "buts." The modern philosophers of the different schools of logical positivism follow in just the same line, but lack both Berkeley's style and his honesty. The consequence of this line of argument is extreme mysticism and irrationality. Ultimately, it results in the notion that only I exist, and that the world only exists insofar as I am present to observe it. If I walk out of the room, it no longer exists, and the like. How did Berkeley deal with this objection? Very easily. There may be objects that are not perceived by my mind, but they are perceived by the "cosmic mind" of God,

and exist in it. Thus, at a single stroke, the Almighty, who was reduced to a precarious existence on the margins of a mechanical universe, has been reintroduced as the "whole choir of Heaven and furniture of the earth," in a world entirely free of matter. In this way, Berkeley believed that he had scored the "most complete and easy triumph in the world" over "every wretched sect of atheists."

In purely philosophical terms, Berkeley's philosophy is open to many objections. In the first place, his main criticism of Locke was that he duplicated the world, that is, he supposed that behind the sense-

perceptions which, according to empiricism, are the only things we can know, there was an external world of material things. To remove this duality, Berkeley simply denied the existence of the objective world. But this does not solve the problem at all. We are still left with something outside our sense-perceptions. The only difference is that this "something" is not the real, material world, but, according to Berkeley, the immaterial world of spirits created by the "cosmic mind" of God. In other words, by taking our sense-impressions as something independent, separate and apart from the objective material world outside us, we quickly land in the realm of spiritualism, the worst kind of

mysticism.

Berkeley's arguments only retain a degree of consistency if one accepts his initial premise, that we can only know sense-impressions, but never the real world outside ourselves. This is put forward dogmatically at the beginning, and all the rest is derived from this proposition. In other words, he presupposes what has to be proved, namely that our sensations and ideas are not the reflection of the world outside us, but things existing in their own right. They are not a property of matter that thinks, of a human brain and nervous system, capable of being investigated and understood scientifically, but

mysterious things of the spirit world, emanating from the mind of God. They do not serve to connect us with the world, but constitute an impenetrable barrier, beyond which we cannot know anything for sure.

By pushing the arguments of empiricism to the limit, Berkeley succeeded in turning it into its opposite. Engels points out that even Bacon in his natural history gives recipes for making gold, and Newton in his old age "greatly busied himself with expounding the Revelation of St. John. So it is not to be wondered at if in recent years English empiricism in the person of some of its representatives—and not the worst of

them—should seem to have fallen a hopeless victim to the spirit-rapping and spirit-seeing imported from America." (Engels, *The Dialectics of Nature*, p. 69.) As we shall see, the propensity for mystical thinking does not disappear, but rather appears to grow in geometrical proportion to the advance of science. This is the price we have to pay for the cavalier attitude of scientists who wrongly imagine that they can get along without any general philosophical principles. Expelled by the front door, philosophy immediately flies back in through the window, and invariably in its most retrograde and mystifying form.

Just as all ideas ultimately are derived

from this objective material world, which is said not to exist by Berkeley, so, in the last analysis, their truth or otherwise is decided in practice, through experiment, by countless observations, and, above all, through the practical activity of human beings in society.

Berkeley lived at a time when science had largely succeeded in freeing itself from the deadly embrace of religion, and had thereby made possible the greatest advances. How did Berkeley's ideas fit in with all this? What kind of explanation do Berkeley's ideas give of the material world? How do they relate to the discoveries of Galileo, Newton and Boyle? For example, the corpuscular theory of matter cannot be

true, according to Berkeley, because there is nothing for it to be true of.

Berkeley rejected Newton's theory of gravity, because it attempted to explain things by "corporeal causes." Naturally enough, since, while the sun and moon, being material, have mass, my sense-impressions of these have none whatever and can exercise a gravitational pull only on my imagination. He likewise disapproved of the most important mathematical discovery of all—the differential and integral calculus, without which the achievements of modern science would not have been possible. But no matter. Since the concept of infinite divisibility of "real

space" ran counter to the basic postulates of his philosophy, he opposed it vehemently. Having set his face against the major scientific discoveries of his day, Berkeley ended his life extolling the properties of tar-water as an elixir to cure all ills. One could be excused for thinking that such an eccentric philosophy as this would vanish without trace. Not so. The ideas of Bishop Berkeley have continued to exercise a strange fascination on bourgeois philosophers down to the present day, being the true origin and basis of the theory of knowledge ("epistemology") of logical positivism and linguistic philosophy. This was dealt with brilliantly by Lenin in his book

Materialism and Empirio-Criticism, to which we shall return later.

Incredible as it may seem, this thoroughly irrational and anti-scientific philosophy has penetrated the thinking of many scientists, through the agency of logical positivism in different guises. In Berkeley's lifetime his ideas did not get much of an echo. They had to wait for the intellectual climate of our own contradictory times, when the greatest advances of human knowledge rub shoulders with the most primitive cultural throwbacks to get accepted in polite society. As G. J. Warnock points out, in the Introduction to *The Principles of Human Knowledge*, Berkeley

philosophy "in our own day has won far more general support than ever before." Thus, "today some physicists...are inclined to argue exactly as he did, that physical theory is not a matter of factual truth, but essentially of mathematical and predictive convenience." (G. J. Warnock, *The Principles of Human Knowledge*, p. 25.) The scientist and idealist philosopher Eddington claimed that we "have a right to believe that there are, for instance, colours seen by other people but not by ourselves, toothaches felt by other people, pleasures enjoyed and pains endured by other people, and so on, but that we have no right to infer events experienced by no one and not forming part of any 'mind.'" (Russell,

op. cit., p. 631.) Logical positivists like A. J. Ayer accept the argument that we can only know "sense-contents" and, therefore, the question as to the existence of the material world is "meaningless." And so on and so forth. Old Berkeley must be laughing in his grave!

The value of any theory or hypothesis is ultimately determined by whether it can be applied successfully to reality, whether it enhances our knowledge of the world and our control over our lives. A hypothesis which does none of these things is good for nothing, the product of idle speculation, like the disputations of the mediaeval Schoolmen about how many angels can dance on the head of a

pin. A colossal amount of time has been wasted in universities on endlessly debating this kind of thing. Even Bertrand Russell is compelled to admit that a theory like Berkeley's, which "would forbid us to speak about anything that we have not ourselves explicitly noticed. If so, it is a view that no one can hold in practice, which is a defect in a theory that is advocated on practical grounds." Yet in the very next sentence he feels obliged to add that "The whole question of verification, and its connection with knowledge, is difficult and complex; I will, therefore, leave it on one side for the present." (Op. cit., p. 632.) These questions are only "difficult and complex" for someone who accepts

the premise that all we can know are sense-data, separate and apart from the material world. Since this is the starting point of a great deal of modern philosophers, no matter how they twist and turn, they cannot dig themselves out of the trap set by Bishop Berkeley.

The End of the Road

The philosophy of empiricism, which began its life with such great expectations, finally comes to a dead stop with David Hume (1711-76). An arch-Tory, Hume followed faithfully in the path laid down by Berkeley, albeit more cautiously. His most famous work, the *Treatise on Human Nature* was

published in 1739 in France where it went down like a lead balloon. For Hume, reality is only a string of impressions, the causes of which are unknown and unknowable. He regarded the question of the existence or non-existence of the world to be an insoluble problem, and was one of the first of those philosophers to translate their ignorance into Greek and call it agnosticism. In essence, what we have here is a throwback to the idea of the Greek sceptics that the world is unknowable.

His main claim to fame rests on the section of his work entitled Of Knowledge and Probability. Here also

he was not original, but merely developed an idea already present in Berkeley, namely the non-existence of causation. Arguing against the discoveries of the newly developed science of mechanics, he tried to show that mechanical causation did not exist, that we cannot say that a particular event causes another event, but only that one event follows another. Thus, if we boil a kettle of water to a hundred degrees centigrade, we cannot say that this action has caused it to boil, but only that the water boiled after we heated it. Or if a man is knocked over by a ten-ton truck, we have no right to affirm that his death was caused by this. It just succeeded it in time. That is all.

Does this seem incredible? But it is the inevitable result of the strict application of this kind of narrow empiricism, which demands of us that we stick to "the facts, and nothing but the facts." All we can say is that one fact follows another. We have no right to assert that one thing actually causes another, since this would be to go beyond the single fact registered by our eyes and ears at a given moment in time. All of which forcibly brings to mind the warning of old Heraclitus: "Eyes and ears are bad witnesses for men who have souls that understand not their language."

Once again, it is astonishing to note that,

of all the marvellous philosophical ideas produced in the last two centuries or so, modern philosophers and scientists choose to take as their starting-point and inspiration the writings of...Hume! His denial of causality has been eagerly seized upon in order to provide some ideological support for certain incorrect philosophical conclusions which Heisenberg and others have attempted to draw from quantum mechanics. We shall speak of that later. In essence, Hume asserts that, when we say "A" causes "B," we only mean that these two acts have been seen together many times in the past, and that, therefore, we believe they may be repeated in the future. This, however, is not a certainty but only a

belief. It is not necessity, but only probability. Thus, "necessity is something that exists in the mind, not in objects."

First of all, to deny causation leads us to the denial of scientific and rational thought in general. The whole basis and "raison d'être" of science is the attempt to provide a rational explanation for the observed phenomena of nature. From the observation of a large number of facts, we draw general conclusions, which, if they have been sufficiently tested and shown to have a wide application, acquire the status of scientific laws. Naturally, all such laws reflect the state of our knowledge at a given stage of

human development, and, consequently, are subsequently overtaken by other theories and hypotheses, which explain things better. In the process, we gradually arrive at a deeper understanding both of nature and ourselves. This process is as limitless as nature itself. Thus, to look for an Absolute Truth, which would explain everything, or, to use a fashionable expression, a Grand Universal Theory (GUT) is about as profitable as looking for the philosopher's stone.

The fact that a particular generalisation may be falsified at a given moment does not entitle us to dispense with generalisations altogether. Nor does it

mean that we have to renounce the search for objective truth, taking refuge in a sceptical attitude, like that of Hume, which, because of its complete and utter irrelevance to our actual practice, whether in science or in everyday life, is really just a pretentious pose, just like the idiotic posing of those who deny the existence of the material world, but who do not, on that account, refrain from eating and drinking, and who, while firmly maintaining the non-existence of causality, are very careful to avoid untimely physical encounters with ten-ton trucks.

All natural laws are based on causality.
The ocean tides are caused by the

gravitational pull of the sun and moon. The splitting of the atom causes a nuclear explosion. Deprivation of food and drink over a long period causes death by starvation, and being run over by a lorry causes the same result by other means. The existence of causality is as certain as anything can be in this sinful material world of ours. But not certain enough for the disciples of Hume. Accepting his line of argument, all future prediction becomes irrational, because there is always the possibility that things will turn out differently. Bertrand Russell, supposedly with a straight face, explains: "I mean that, taking even our firmest expectations, such as that the sun will rise tomorrow,

there is not a shadow of reason for supposing them more likely to be verified than not." (Op. cit., p. 641.) Further on he says: "For example: when (to repeat a former illustration) I see an apple, past experience makes me expect that it will taste like an apple, and not like roast beef; but there is no rational justification for this expectation." (Ibid., p. 643.)

Since we cannot know anything, according to Hume, he concludes that "all our reasonings concerning causes and effects are derived from nothing but custom; and that belief is more properly an act of the sensitive, than of the cogitative part of our natures." (Hume,

Book 1, part 3, sect. 4.) In other words, knowledge is abandoned in favour of belief.

It should be borne in mind that the declared intention of all this is to eliminate metaphysics from thought, which will thus be limited to a bare and, hopefully, scientific enumeration of the "facts." Some wit once defined metaphysics as "a blind man, in a dark room, looking for a black hat which isn't there." This phrase adequately describes the metaphysical fumbling of those who, by denying causation immediately open the door to irrationality. With Hume, empirical philosophy comes full circle. As Russell correctly says:

"The ultimate outcome of Hume's investigation of what passes for knowledge is not what we must suppose him to have desired. The sub-title of his book is: 'An attempt to introduce the experimental method of reasoning into moral subjects.' It is evident that he started out with a belief that scientific method yields the truth, the whole truth, and nothing but the truth; he ended, however, with the conviction that belief is never rational, since we know nothing. After setting forth the arguments for scepticism (Book I, part iv, sec. i), he goes on, not to refute the arguments, but to fall back on natural credulity." (Op. cit., p. 644.)

One may be tempted to ask what the practical worth of such a philosophy is. On this point no answer is forthcoming from Hume, who comments with the utmost frivolity, tinged with cynicism: "This sceptical doubt, both with respect to reason and the senses, is a malady, which can never be radically cured, but must return upon us every moment, however we may chase it away, and sometimes may seem entirely free from it...Carelessness and inattention alone can afford us any remedy. For this reason I rely entirely upon them; and take it for granted, whatever may be the reader's opinion at this present moment, that an hour hence he will be persuaded there is both an external and an internal

world." (Op. cit., p. 645.) This is not real philosophy but precisely a metaphysical dead end. It tells us nothing about the world, and leads nowhere. Just what one would expect from a man who thought that there was no reason to study philosophy except as a pleasant way of passing the time. And indeed, there is certainly no reason to study Hume's philosophy except as a pointless way of wasting time.

On one thing we can agree with Bertrand Russell. The philosophy of Hume represents "the bankruptcy of 18th-century reasonableness." Hume's ideas, like Berkeley's, represent a move in the direction of subjective idealism. It is

empiricism turned inside out. From the starting point that everything was learnt from experience, we arrive at the conclusion that nothing can be learnt from experience and observation. This is the antithesis of the progressive scientific spirit with which the period opened. Nothing positive can be obtained from such an outlook. We may therefore safely leave those who cannot be sure that the sun will rise tomorrow where we found them—in the dark, where they can find some consolation for their difficulties by looking forward one day to eating an apple which tastes like roast beef.

The Birth of French Materialism

From this point on, the road to further development of philosophy in Britain was blocked, but not before it had given a powerful impulse to the movement which became known as the Enlightenment in France. The difference between English empiricism and French materialism is sometimes ascribed to difference of national temperament. For instance:

"To carry out the empiricism of Locke into its ultimate consequence, into sensualism and materialism—this is the task which has been assumed by the French. Though grown on a soil of English principles, and very soon universally prevalent there, empiricism

could not possibly be developed amongst the English into the extreme form which presently declared itself among the French—that is, into the complete destruction of all the foundations of the moral and religious life. This last consequence was not congenial to the national character of the English." (Schwegler) (Schwegler, op. cit., p. 184.)

The existence of different national temperaments and traditions undoubtedly played a major role, as Marx and Engels pointed out in *The Holy Family*: "The difference between French and English materialism reflects the difference between the two nations. The French

imparted to English materialism wit, flesh and blood, and eloquence. They gave it the temperament and grace that it lacked. They civilised it." (MECW, Vol. 4, pp. 129-30.)

Nonetheless, to explain great historical movements it is not sufficient to appeal to national characteristics alone. The character of the French and English were also different a hundred years before, without producing either Hume or Voltaire, who were products of their own time, or, more accurately, products of a particular concatenation of circumstances, social, economic and cultural. The philosophy of Berkeley and Hume emerged in a period when the

bourgeoisie had already triumphed, and was trying to lay revolution to rest. That of Concordet, Diderot and Voltaire belongs to an entirely different period—the period of social and intellectual ferment leading up to the revolution of 1789-93. In an important sense the struggle of the "philosophers" against religion and orthodoxy was a preparation for the storming of the Bastille. Before the old order was overthrown in fact, it first had to be shown to be redundant in the minds of men and women.

In his excellent essay on Holbach and Helvtius, Plekhanov has this to say about 18th century French philosophy:

"Eighteenth-century materialist philosophy was a revolutionary philosophy. It was merely the ideological expression of the revolutionary bourgeoisie's struggle against the clergy, the nobility, and the absolute monarchy. It goes without saying that, in its struggle against an obsolete system, the bourgeoisie could have no respect for a world-outlook that was inherited from the past and hallowed that despised system. 'Different times, different circumstances, a different philosophy,' as Diderot so excellently put it in his article on Hobbes in the *Encyclopdie*." (Plekhanov, *Selected Philosophical Works*, Vol. 2, p. 45.)

The ideas of Locke had a great impact on the Abbe de Condillac (1715-80). Condillac accepted Locke's teaching that all knowledge comes from the senses, but went even further, claiming that all mental processes, even the will, are only modified sensations. He never actually denied the existence of God, but nevertheless maintained that only matter existed. A very remarkable conclusion for someone who was a priest. Another disciple of Locke, Claude Adrien Helvtius (1715-71), with whom, said Marx, "materialism assumed a really French character." Helvtius was so outspoken that even his fellow materialists were taken aback, and did not dare follow him in his bold

conclusions.

Baron Holbach (1723-89), although a German, spent most of his life in France, where he played a major role in the materialist movement. Like Helvtius, he was persecuted by the Church, and his book *Le Systme de la Nature* was publicly burnt by order of the Paris Parliament. A determined materialist, Holbach attacked religion and idealism, especially the ideas of Berkeley. Locke already thought it possible that matter could possess the faculty of thinking, and Holbach enthusiastically agreed, but, unlike Locke, was prepared to draw all the conclusions, throwing religion and the Church out of the window:

"If we consult experience, we shall see that it is in religious illusions and opinions that we should seek for the real source of the host of evils that we everywhere see overwhelming mankind. Ignorance of natural causes has led it to create its Gods; deception has made the latter terrible; a baneful concept of them has pursued man without making him any better, made him tremble uselessly, filled his mind with chimeras, opposing the progress of reason, and hindering the search for happiness. These fears have made him the slave of those who deceived him under the pretext of caring for his good; he did evil when he was told that his Gods called for crimes; he lived in adversity because he was made

to hear that his Gods had condemned him to misery; he never dared to resist his Gods or to cast off his fetters, because it was drummed into him that stupidity, the renunciation of reason, spiritual torpor and abasement of the soul were the best means of winning eternal bliss." (Quoted in Plekhanov, op. cit., p. 72.)

La Mettrie (1709-51) went still further in recognising that all forms of life, plant and animal (including man), consisted of matter organised in different ways. His main works were the famous *L'Homme Machine*, (Man, a Machine), and *Le Systme d'Epicure* (The System of Epicurus). La Mettrie was partly a follower of Descartes, who said that

animals were machines in the sense that they could not think. Taking this literally, La Mettrie said that man also must be a machine, then, because there was no qualitative difference between man and the animals. This merely reflects the predominant influence of mechanics on the scientific thinking of the period.

The intention of La Mettrie was to oppose the idea that man was a special creation of God, something entirely set aside from the rest of nature, by the special privilege of an immortal soul. This argument, in effect, was already disposed of by the English materialist and scientist Joseph Priestley, remembered today mainly as the

discoverer of oxygen:

"The power of cutting, in a razor, depends upon a certain cohesion, and arrangement of the parts of which it consists. If we suppose this razor to be wholly dissolved in any acid liquor, its power of cutting will certainly be lost, or cease to be, though no particle of the metal that constituted the razor be annihilated by the process; and its former shape, and power of cutting, etc., may be restored to it after the metal has been precipitated. Thus when the body is dissolved by putrefaction, its power of thinking entirely ceases." (Quoted in Plekhanov, *op. cit.*, p. 82, footnote.)

La Mettrie considered that thought was one of the properties of matter:

"I believe thinking to be so little incompatible with organised matter that it seems to be a property of the latter in the same way as electricity, the faculty of movement, impenetrability, extent, etc." (Ibid., p. 333.)

From the radical materialism and rationalism of the Enlightenment it was easy to draw revolutionary conclusions, and this was done. Voltaire (1694-1778), although not really a philosopher, played a prominent role in this movement, as a writer, historian and pamphleteer. He was arrested twice for

his political satires, and had to spend most of his life outside France.

Voltaire's greatest contribution was his collaboration with Diderot in the great Encyclopaedia (1751-80) a massive undertaking which gave a systematic summary of all the scientific knowledge of the time. A galaxy of the greatest French thinkers participated in this unique task: Montesquieu, Rousseau, Voltaire, Holbach, Helvtius, and other progressive and materialist philosophers combined to produce a militant work directed against the basis of the existing social order, its philosophy and morality.

Compared to the writings of the French

materialists, the philosophical views of Jean-Jacques Rousseau represent a step backwards. Nevertheless, in the field of social criticism, he produced a number of masterpieces, and Engels specifically singles out for praise his work *The Origins of Inequality Among Men*. Still, as he is also not really a philosopher in the strict sense, we will not enter into his ideas more fully here.

In general, these writers were preparing the ground for the bourgeois revolution of 1789-93. Their fierce denunciations are directed against the evils of feudalism and the Church. The ideal for most of them was a constitutional monarchy. Nevertheless, it is easy to see

how later on people began to draw socialist and communist conclusions from their writings:

"There is no need for any great penetration," say Marx and Engels, "to see from the teaching of materialism on the original goodness and equal intellectual endowment of men, the omnipotence of experience, habit and education, and the influence of environment on man, the great significance of industry, the justification of enjoyment, etc., how necessarily materialism is connected with communism and socialism. If man draws all his knowledge, sensation, etc., from the world of the senses and the

experience gained in it, then what has to be done is to arrange the empirical world in such a way that man experiences and becomes accustomed to what is truly human in it and that he becomes aware of himself as man.

"If correctly understood interest is the principle of all morality, man's private interest must be made to coincide with the interest of humanity. If man is unfree in the materialistic sense, i.e., is free not through the negative power to avoid this or that, but through the positive power to assert his true individuality, crime must not be punished in the individual, but the anti-social sources of crime must be destroyed, and each man must be given

social scope for the vital manifestation of his being. If man is shaped by environment, his environment must be made human. If man is shaped by nature, he will develop his true nature only in society, and the power of his nature must be measured not by the power of the separate individual but by the power of society." (MECW, Vol. 4, pp. 130-1.)